

Nanowire Photovoltaic Devices, Phase II

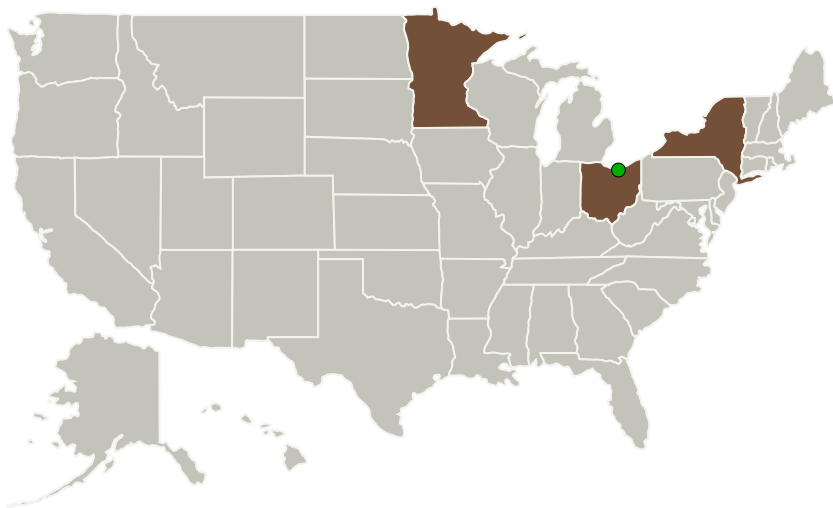
Completed Technology Project (2011 - 2013)



Project Introduction

Firefly, in collaboration with Rochester Institute of Technology, proposes developing a space solar cell having record efficiency exceeding 40% (AM0) by the introduction of nanowires within the active region of the current limiting sub-cell. The introduction of these nanoscale features will enable realization of an intermediate band solar cell (IBSC), while simultaneously increasing the effective absorption volume that can otherwise limit short-circuit current generated by thin quantized layers. The triple junction cell follows conventional designs comprised of bottom Ge cell (0.67eV), a current-limiting middle GaAs (1.43eV) cell, and a top InGaP (1.90eV) cell. The GaAs cell will be modified to contain InAs nanowires to enable an IBSC, which is predicted to demonstrate ~45% efficiency under 1-sun AM0 conditions. The InAs nanowires will be implemented in-situ within the epitaxy environment, which is a significant innovation relative to conventional semiconductor nanowire generation using ex-situ gold nanoparticles. Successful completion of the proposed work will result in ultra-high efficiency, radiation-tolerant space solar cells that are compatible with existing manufacturing processes. Significant cost savings are expected with higher efficiency cells, enabling increased payload capability and longer mission durations.

Primary U.S. Work Locations and Key Partners



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| Organizations Performing Work | Role | Type | Location |
|--|-------------------------|---|------------------------|
| Firefly Technologies | Lead Organization | Industry Women-Owned Small Business (WOSB) | Shakopee, Minnesota |
| ● Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |
| Rochester Institute of Technology(RIT) | Supporting Organization | Academia | Rochester, New York |

Primary U.S. Work Locations

| | |
|-----------|----------|
| Minnesota | New York |
| Ohio | |

Project Transitions

**July 2011:** Project Start**November 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/139157>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Firefly Technologies

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

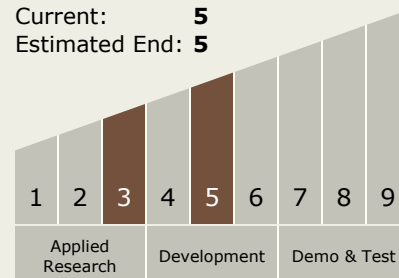
Carlos Torrez

Principal Investigator:

David A Forbes

Technology Maturity (TRL)

Start: 3
Current: 5
Estimated End: 5



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.2 Energy Storage
 - └ TX03.2.2 Electrochemical: Fuel Cells

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System